경제학석사 학위논문

Effect of Land Supply on Housing Price in China

중국의 주택 가격에 대한 토지 공급의 영향

2012 년 7 월

서울대학교 대학원

경제학부 경제학 전공

Dang Wei

Effect of Land Supply on Housing Price in China

지도교수 이근

이 논문을 경제학석사 학위논문으로 제출함
2012 년 7 월

서울대학교 대학원
경제학부 경제학 전공
Dang Wei

당웨이의 석사 학위논문을 인준함

2012 년 7 월

위 원 장 Xu Chenggang (인)

부위원장 李 根 (인)

위 원 Xifang Sun (인)

Abstract

Effect of Land Supply on Housing Price in China

Dang Wei

Department of Economics

The Graduate School

Seoul National University

China started to establish a comprehensive real estate market in1998. China government started to intervene the real estate market and restrict the land supply in 2002. From then on, a series provisions had been publicized, which required to forbid private land transactions and establish the national land purchase and reserve system, so that the Chinese government monopolizes the land supply market. Almost at the same time, there was a rapid decline in the China land supply, which corresponded with the steep and continuous increase in housing price. Many theory and empirical literatures conclude that housing price reflect not only economic fundamentals but also government's policies. Therefore, it is reasonable to regard the land policy as a very important factor which affects the China housing price significantly. In this paper, we analyzed the housing demand, housing supply and government's land supply through a theoretical model. Subsequently, we built a panel data model and analyzed

empirically through the data of 35 key cities in China. The results show that there is a significant negative relationship between China land supply and housing price. Especially, when we compared the results before and after China government's land monopolization, we found that the negative relationship is more prominent after the land macro-control. Therefore, we believe that the increase in housing prices after 2002 can be attributed largely to the tight land policy. Then, we analyzed an individual cities through the time series model. In this process, we builded the empirical model; employed VAR model to find out the impulse response of housing price to land supply. Finally, we concluded that: the housing price in China have already deviated upward from the growth path of economic fundamentals. The restriction of land supply is the most important reason of this. Therefore, if we want to solve the housing price problem, we should not ignore the problem of land supply. The only way to make housing price come back to the normal growth path of economic fundamentals is lifting the constriction of land supply.

Keywards : housing price, land supply, land restriction, monopolize, panel data model, VAR model

Student Number : 2008-22465

Contents

Table

Figure

1. Introduction

In 1998, China government abolished the welfare housing distribution system nationwide and started to establish a comprehensive real estate market. In the early stages of the real estate marketization, the housing price was stable . The steady lasted only until about 2004. From then on, China housing price has climbed steeply and set new record continually. The data shows that the housing price had increased by 18.5% from 1998 to 2003, meanwhile the average anural growth rate was 3.47%. But from 2004 to 2010, the housing price had increased by an astonishing 115.07%, and the average annual growth rate was 11.87%. Comparing with the steep increase of housing price after 2004, there was not such a great change about the per capita disposable income in China. From 1998 to 2003, the urban per capita disposable income had increased by 56.17%, meanwhile the average anural growth rate was 9.39%. From 2004 to 2010, the urban per capita disposable income had increased by 102.83%, and the average anural growth rate was 12.35%. Therefore, it is difficult to explain the steep increase of housing price after 2004 through the income aspect.

Something should be noted is that, from the beginning of 21 century, China government started to adopt the land regulation which was learned from Hong Kong. China government started to intervene the land market in 2002, and publicized a provision in 2004 which strictly required to forbid the private land transactions. Meanwhile, the China government began to implement a land reserve system, and monopolize the land supply effectively. It is difficult to believe that all of this just is an accident, that the great

increase of housing price and the great change of land policy occurred almost at the same time.

We reviewed the literatures about housing price, especially the literatures from Hong Kong, since Hong Kong and China main land adopt the same land regulation-the government monopolizes the land supply. Many of the literatures suggest that there is a close relationship between the housing price and the land supply. Paul Cheshire (2004) researched the situation of British and suggested that the increase of income and the control about land are the two reasons of the increase of housing price in British. He said that if the residential land is still restricted strictly, the housing price will increase continually in future. Ruijue Peng & William C. Wherton (1994) wrote the first formal econometric analysis of the housing market of Hong Kong. They analyzed the data from 1965 to 1990, which captured Hong Kong housing price and land supply, and suggested that land supply restrictions lead to an anticipated reduction in overall land supply, the housing market (correctly) expects higher future housing rents. In a rational market, such an expectation is capitalized into higher current housing prices. Raymond Y. C. Tse (1998) analyzed the data from 1976 to 1995, suggested that the Hong Kong government has acted as a revenue-maximiser in public land sales. Land prices are reflect the scarcity of land relative to other factor inputs. Hong Zhang (2008) analyzed the data from 30 provinces of China, and suggested that Chinese government monopolizes the supply of urban land and affects the real estate market and macro-economic through the land supply policy. They also suggested that a real estate market price increase causes more land to be

supplied in the short term, but the increase of land supply causes real estate prices to decrease over the long term. Jinhai Yan, Lei Feng, Helen X. H. Bao (2010) analyzed the quarterly data from Beijing over the period from 2000 to 2007, and suggested that the overall effect of land supply on house price dynamics can be substantial when land supply changes significantly over a short period of time. And land supply has significant impacts on house prices both in the long-run and the short-term.

Thus, we believe that, in order to explain the steep increase of China housing price after 2004, it is necessary and reasonable to research the land supply in China. For the purpose, we did the work as follows:

First, we read over all of the documents about land supply and land reserve system over the period from 1998 to now, which publicized by China central government. We also sorted the documents and summarized the process and methods of government land monopolization.

Second, we studied the literatures carefully, which describe the housing price and land supply about Hong Kong and China main land., and we also found limitations of them. For example, Ruijue Peng & William C. Wherton (1994) suggested that land supply impacts housing price through the expected rate of future house price appreciation. But they did not consider the effect of land monopolization on housing price, or on housing demand and supply. Hong Zhang (2008) used China's provincial-level panel data and estimated the equilibrium housing price which was

derived from the stock-flow model. But the actual housing price is different with equilibrium housing price. It is unreasonable to ignore the accumulation effect of housing price. Also, provincial-level panel data has problems similar to the national data, since they are all the added or averaged data. Actually, there are huge difference between cities even in the same province of China. Jinhai Yan, Lei Feng, Helen X. H. Bao (2010) researched the land supply and housing price in Beijing perfectly. But the more cities need to be researched, if we want to describe the situation of total China.

Third, considering housing price may adjust only gradually in response to shocks (DiPasquale and Wheaton 1990; Hadjimatheou 1976; Whitehead 1974), we introduced a lagged housing price to extend the traditional stock-flow model. We also introduced the variables which capture the land supply and land monopolization policy, and derived the empirical model.

Fourth, we estimated the housing price using the panel data of 35 key cities over the period from 1999 to 2010, which are widely distributed in China and represent all the economic level cities. And we summarized the effect of land supply and land monopolization on housing price in China based on our regression results.

According the work mentioned above, the rest of the paper is organized as follows: Section 2 reviews the evolution of China's real estate market and land policy. Section 3 preliminarily analyzes the relationship between housing price and land supply based on

the data of 35 key cities. Section 4 builds the theoretical model. Section 5 introduces the empirical model according to the theoretical model in previous. Section 6 estimates the housing price through the empirical model using the data of 35 key cities, and analyzes our regression results. Section 7 builds a time series model and VAR model to research the situation of Beijing for example. Finally, we summarize the conclusion of the paper.

2. The System of Land Supply in China

The Chinese Constitution stipulates that the land of urban areas of China is state-owned, rural land is collectively owned. Ownership of the land can not be transferred. The land demander can only buy a certain number of years of land use rights.

Prior to 1980, China implemented the welfare housing system. In this system, the government built the welfare housing and distributed to residents in accordance with the Government's housing allocation plan.At that time, the sale of welfare housing is illegal and prohibited.Later, after a series of reforms, the government had gradually established a two-track housing system.The Chinese government allowed the existence of the real estate market in some cities, but still retained the welfare housing system. Until 1998, the Chinese government published the provision for the "Notice on the Deepening of Housing Reform and Fasten Housing Construction" , declared the establishment of the China real estate market, but also declared the end of the welfare housing system era. Since then, residents need to buy houses in the real estate market to solve the housing problem.

In the early stages of the establishment of Chinese real estate market, the Government has not clearly defined how to trade state-owned land use rights. At that time, there are many ways of land use rights transactions: private negotiations, public bidding, auction and listing. Before 2002, the land administration department allocated land use rights to enterprises and institutions. The government also allowed these enterprises to transfer the land use rights which was allocated to them, if they paid the land-use rights transfer payments to the government. Therefore, a large number of land users transferred their land use right to the new land users through private negotiations. The statistical results show that in most years before 2002, the private negotiations accounted for more than 90 percent of all land transactions. The bid accounted for about 2%. The auction accounted for only about 8%.

In May 2002, the central government publicized the provision for **the Transferring State-owned Land by Bids, Auction or Listing.** Through this provision, the Chinese government banned the private negotiation transaction of land use rights, and declared that all land use rights transactions must follow the ways of bidding, auction and listing. The publishment of this provision, is considered to be the beginning of a new "land revolution".

However, in 2002, the lands which transferred through bidding, auction or listing, only accounted for 16.02% of total amount of land transactions. The lands which transferred through private negotiation and government allotment, accounted for 88.8%. At the same time, illegal land use cases happened frequently, many of them related to violations about land transfer regulations.

In order to totally forbade to transfer land use rights through private negotiation, the Chinese government publicized the provision for the "Continue Supervising the Situation that If the Land Use Rights is Transferred According to the Way of Bidding, Auction and Listing" in 2004. The provision required that previous land transfer issues must be solved before August 13, 2004. Otherwise, the relative government departments have the rights to recover the land, and incorporate it into the national land reserve system. This incident is known as the "8.13 Doomsday" .Since then, housing price and land supply has been a hot topic in China.

The one hand, the Chinese government forbade land transactions through private negotiation, and promulgated a series of provisions to regulate the ways of the land use rights transactions. Meanwhile, on the other hand, the Chinese government began to implement a land reserve system.

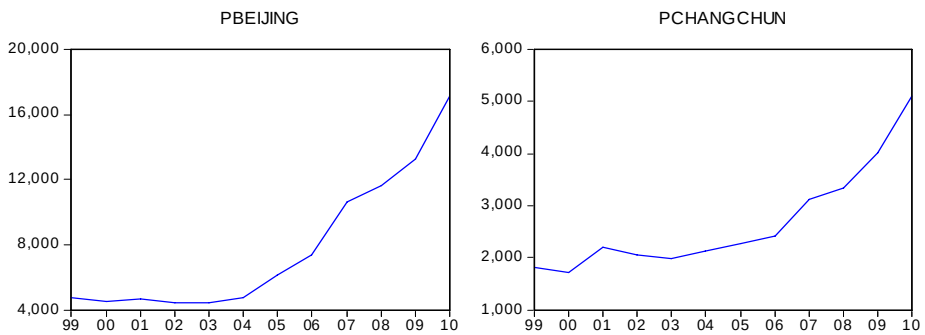
China is a public ownership country, the constitution confers the government the authority to instead of nationals to exercise the right of land management. The government has the rights of land use rights transaction and land acquisition. It is natural, in theory, the Chinese government monopolizes the land market. However, due to the large number of land use rights had been allocated to state enterprises and real estate enterprises, the government allows them to be transferred according to the certain regulations. In fact, it was difficult that the government monopolized the land market effectively. A lot of undeveloped lands entered into the market through various channels. Under the background, the national land reserve system was born.

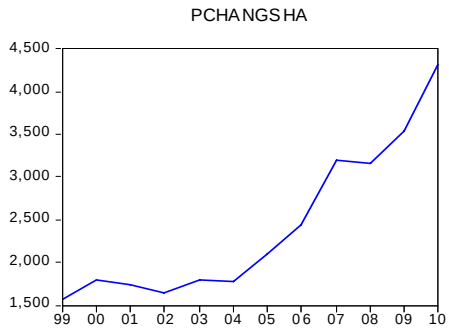
In 2001, China government publicized a provision, which required the local governments try to implement the land reserve system. And it also required national and local credit sectors support local governments' land purchase. From then on, China government began to purchase and reserve land fully. After that, China government publicized another series provisions, which required local governments control the construction land supply strictly, increase the land tax, supervise the land use right transactions strictly, and so on.

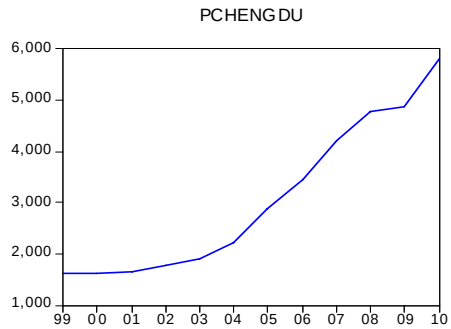
Forbidding private land transactions and establishing national land purchase and reserve system, both of which led the China government to be the only monopolizer in China land supply market effectively.

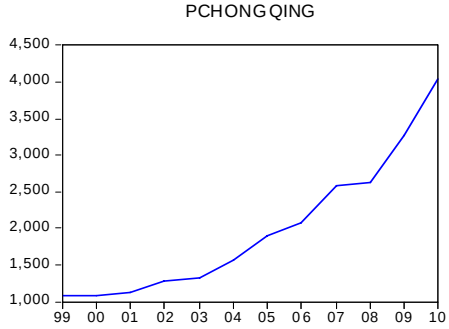
3. Housing Price and Land Supply in China

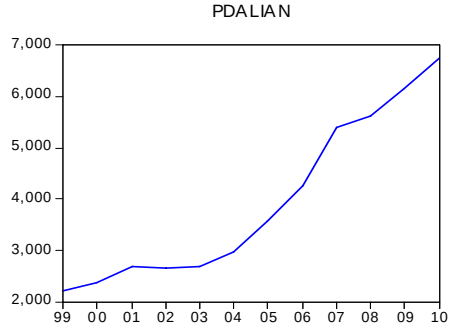
Chinese statistics of real estate data about 35 main cities in China was began from 1999. These cities are widely distributed in China, and reflect the Chinese real estate market well. Our research begins with the data of the 35 cities. First, we draw the following graph about the housing prices of the 35 main cities.

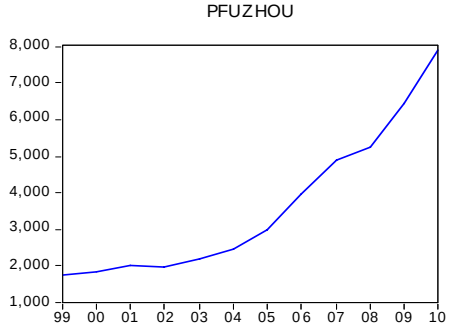


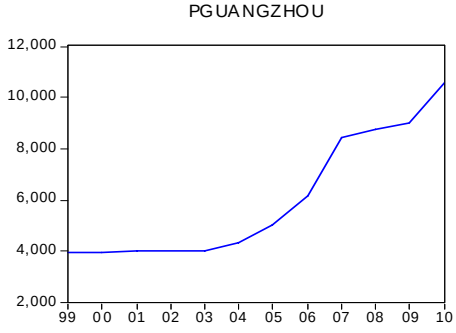

PCHANGSHA
4,500
4,000
3,500
3,000
2,500
2,000
1,500
99 00 01 02 03 04 05 06 07 08 09 10

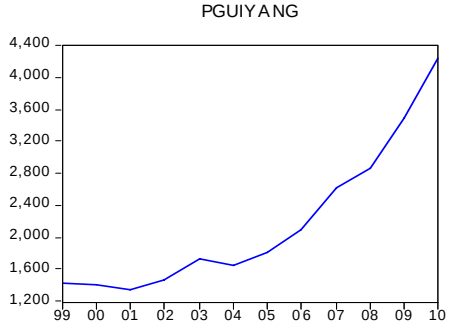

PCHENGDU
6,000
5,000
4,000
3,000
2,000
1,000
99 00 01 02 03 04 05 06 07 08 09 10

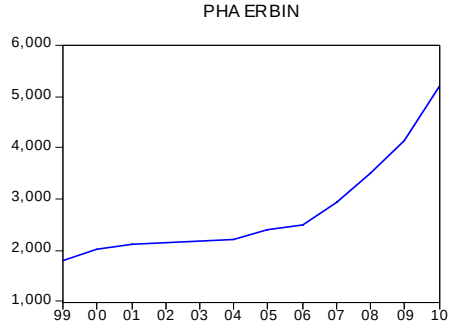

PCHONGQING
4,500
4,000
3,500
3,000
2,500
2,000
1,500
1,000
99 00 01 02 03 04 05 06 07 08 09 10

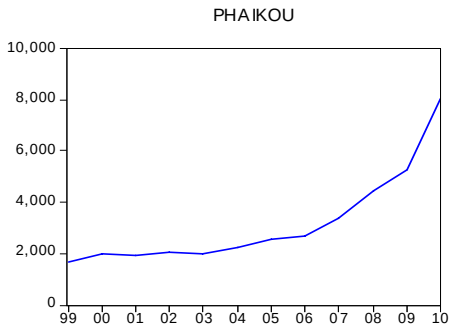

PDALIAN
7,000
6,000
5,000
4,000
3,000
2,000
99 00 01 02 03 04 05 06 07 08 09 10

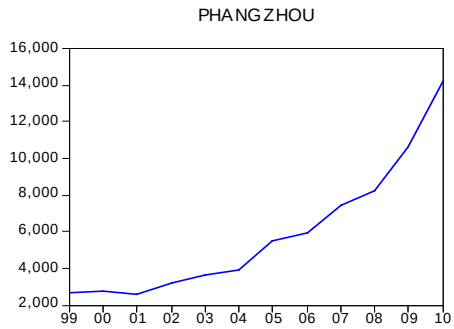

PFUZHOU
8,000
7,000
6,000
5,000
4,000
3,000
2,000
1,000
99 00 01 02 03 04 05 06 07 08 09 10

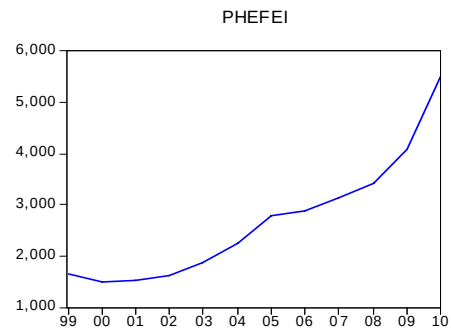

PGUANGZHOU
12,000
10,000
8,000
6,000
4,000
2,000
99 00 01 02 03 04 05 06 07 08 09 10

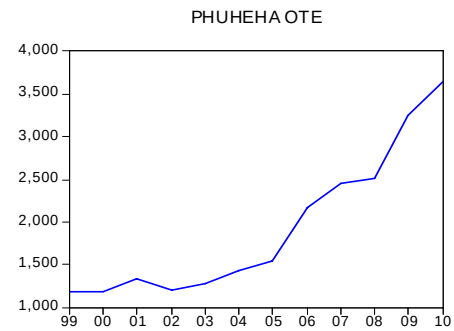

PGUIYANG
4,400
4,000
3,600
3,200
2,800
2,400
2,000
1,600
1,200
99 00 01 02 03 04 05 06 07 08 09 10

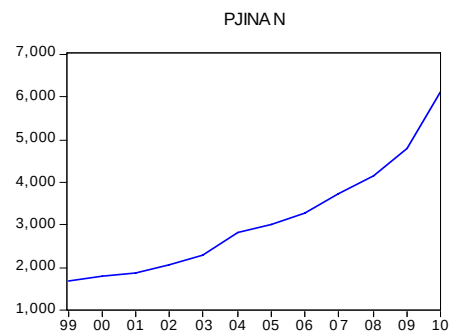

PHAERBIN
6,000
5,000
4,000
3,000
2,000
1,000
99 00 01 02 03 04 05 06 07 08 09 10

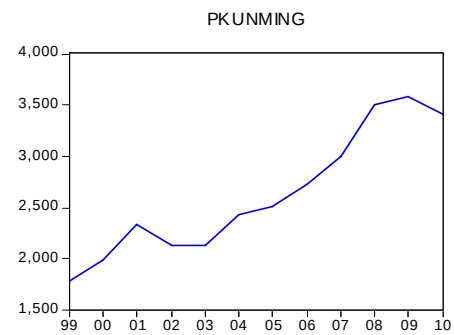

PHAIKOU
10,000
8,000
6,000
4,000
2,000
0
99 00 01 02 03 04 05 06 07 08 09 10

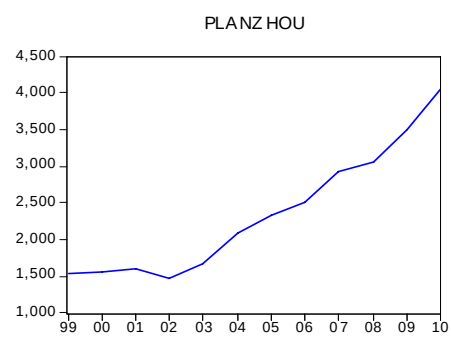

PHANGZHOU
16,000
14,000
12,000
10,000
8,000
6,000
4,000
2,000
99 00 01 02 03 04 05 06 07 08 09 10

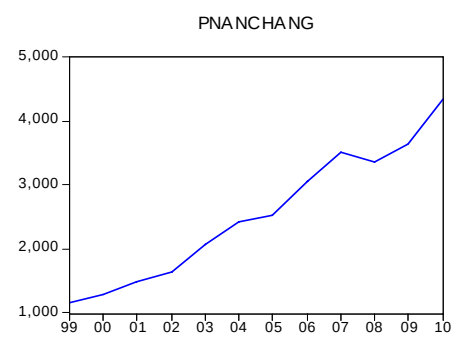

PHEFEI
6,000
5,000
4,000
3,000
2,000
1,000
99 00 01 02 03 04 05 06 07 08 09 10

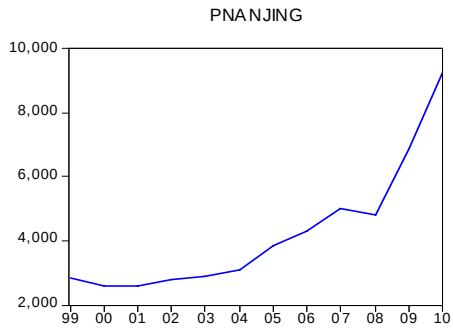

PHUHEHAOTE
4,000
3,500
3,000
2,500
2,000
1,500
1,000
99 00 01 02 03 04 05 06 07 08 09 10

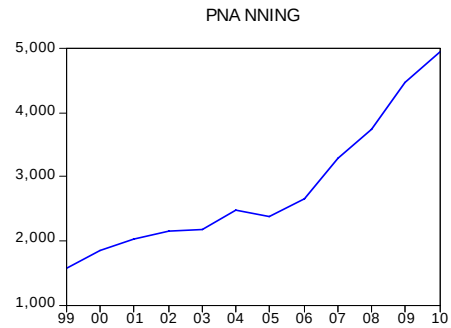

PJINAN
7,000
6,000
5,000
4,000
3,000
2,000
1,000
99 00 01 02 03 04 05 06 07 08 09 10

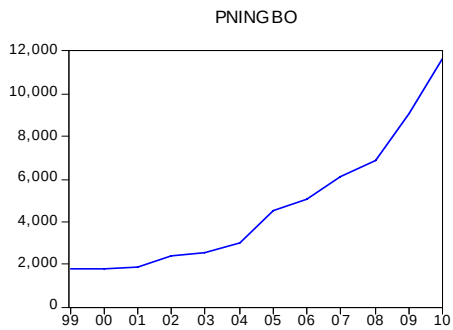

PKUNMING
4,000
3,500
3,000
2,500
2,000
1,500
99 00 01 02 03 04 05 06 07 08 09 10

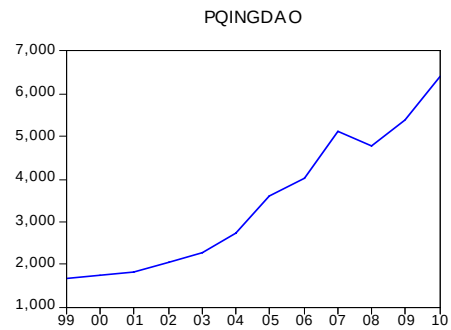

PLANZHOU
4,500
4,000
3,500
3,000
2,500
2,000
1,500
1,000
99 00 01 02 03 04 05 06 07 08 09 10

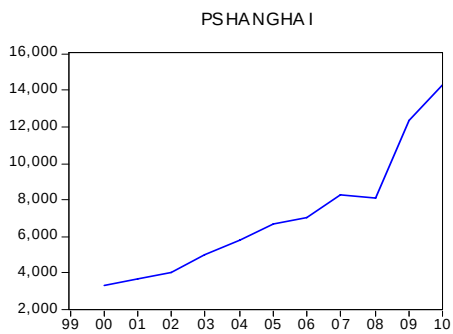

PNANCHANG
5,000
4,000
3,000
2,000
1,000
99 00 01 02 03 04 05 06 07 08 09 10

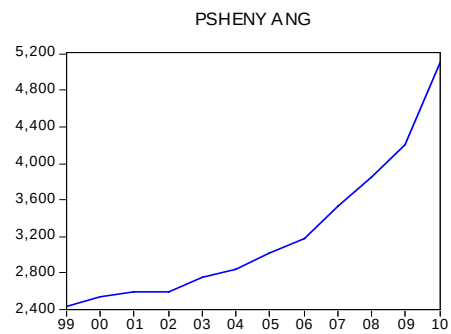

PNANJING
10,000
8,000
6,000
4,000
2,000
99 00 01 02 03 04 05 06 07 08 09 10

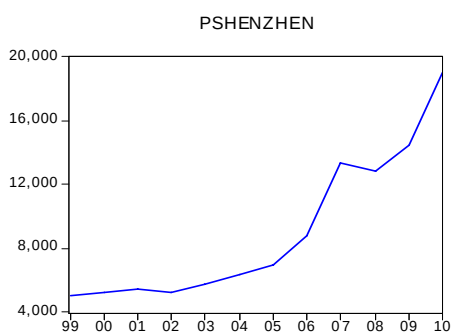

PNANNING
5,000
4,000
3,000
2,000
1,000
99 00 01 02 03 04 05 06 07 08 09 10

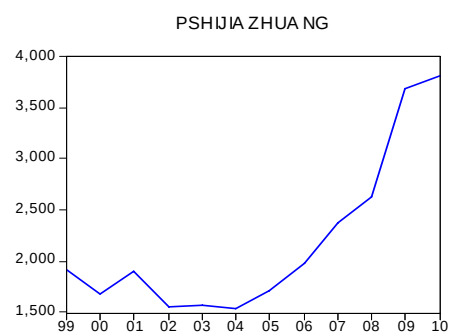

PNINGBO
12,000
10,000
8,000
6,000
4,000
2,000
0
99 00 01 02 03 04 05 06 07 08 09 10

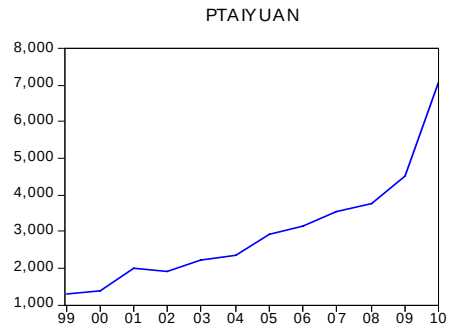

PQINGDAO
7,000
6,000
5,000
4,000
3,000
2,000
1,000
99 00 01 02 03 04 05 06 07 08 09 10

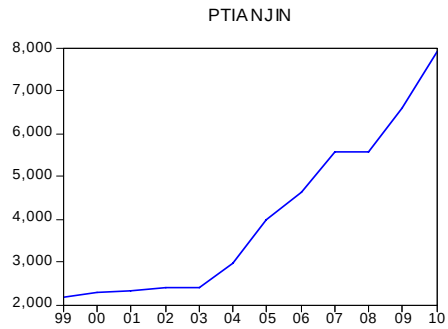

PSHANGHAI
16,000
14,000
12,000
10,000
8,000
6,000
4,000
2,000
99 00 01 02 03 04 05 06 07 08 09 10

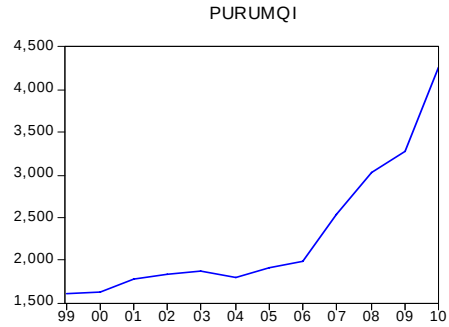

PSHENYANG
5,200
4,800
4,400
4,000
3,600
3,200
2,800
2,400
99 00 01 02 03 04 05 06 07 08 09 10

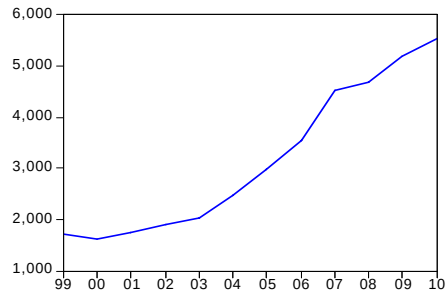

PSHENZHEN
20,000
16,000
12,000
8,000
4,000
99 00 01 02 03 04 05 06 07 08 09 10

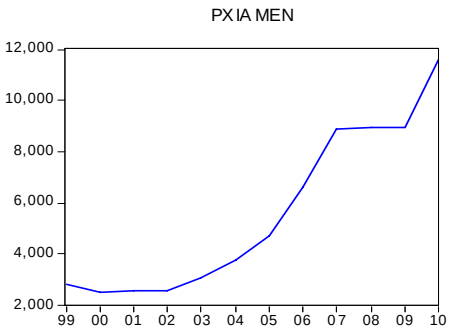

PSHIJIAZHUANG
4,000
3,500
3,000
2,500
2,000
1,500
99 00 01 02 03 04 05 06 07 08 09 10

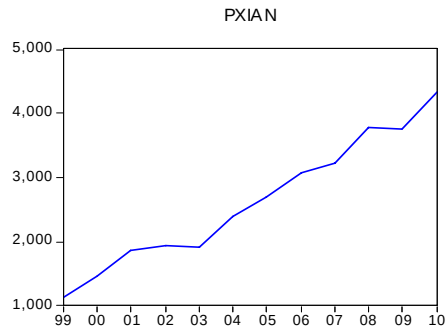

PTAIYUAN
8,000
7,000
6,000
5,000
4,000
3,000
2,000
1,000
99 00 01 02 03 04 05 06 07 08 09 10

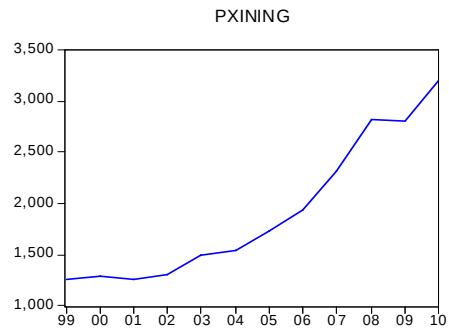

PTIANJIN
8,000
7,000
6,000
5,000
4,000
3,000
2,000
99 00 01 02 03 04 05 06 07 08 09 10

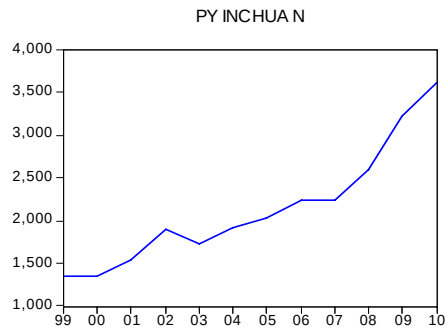

PURUMQI
4,500
4,000
3,500
3,000
2,500
2,000
1,500
99 00 01 02 03 04 05 06 07 08 09 10

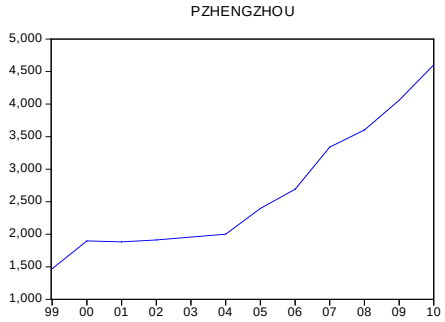

PWUHAN
6,000
5,000
4,000
3,000
2,000
1,000
99 00 01 02 03 04 05 06 07 08 09 10


PXIAMEN
12,000
10,000
8,000
6,000
4,000
2,000
99 00 01 02 03 04 05 06 07 08 09 10


PXIAN
5,000
4,000
3,000
2,000
1,000
99 00 01 02 03 04 05 06 07 08 09 10


PXINING
3,500
3,000
2,500
2,000
1,500
1,000
99 00 01 02 03 04 05 06 07 08 09 10

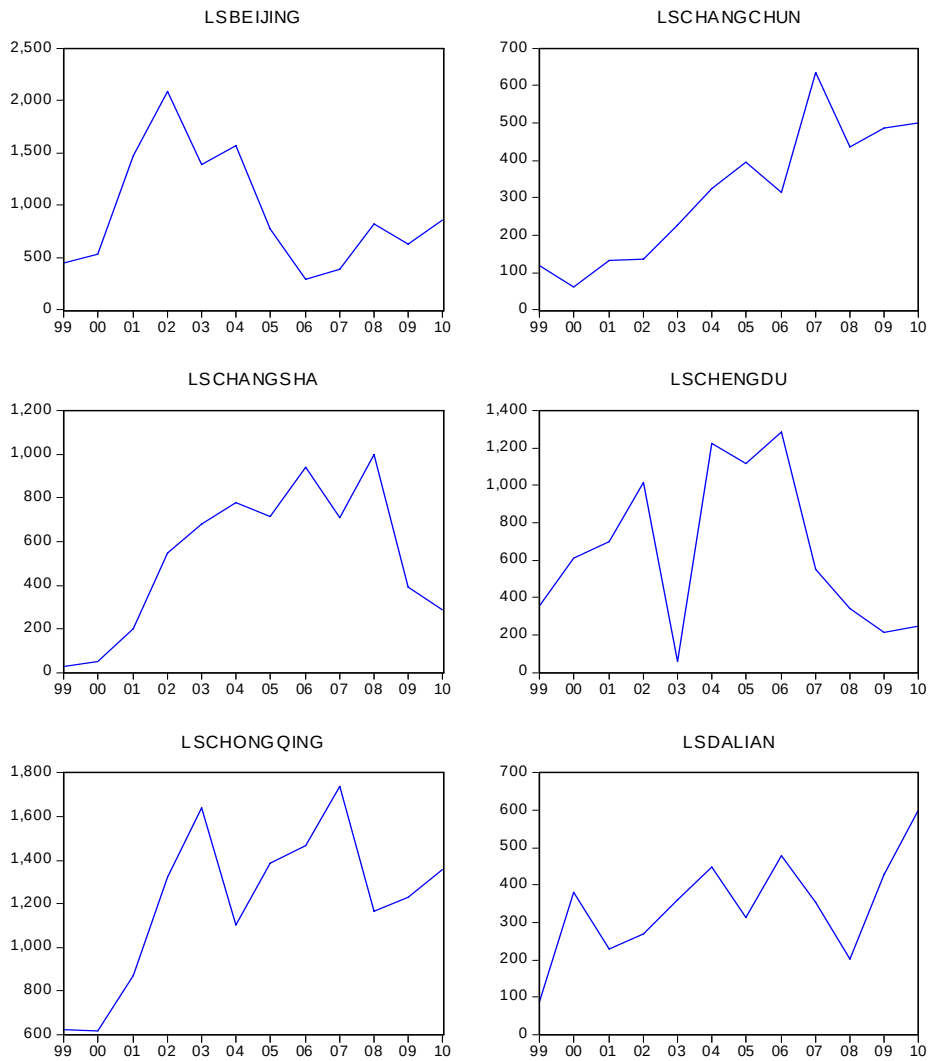

PYINCHUAN
4,000
3,500
3,000
2,500
2,000
1,500
1,000
99 00 01 02 03 04 05 06 07 08 09 10

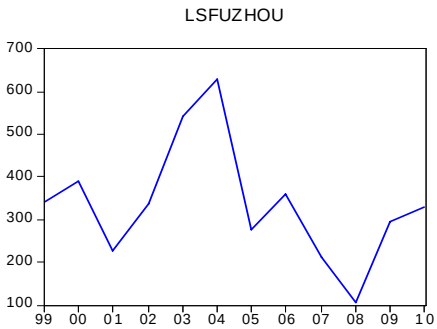


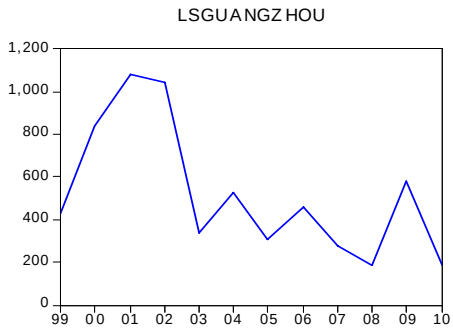
From the graph above, we can see the change of housing prices of many cities in China. Before 2004, housing prices were stable in many cities. There even was a decline of the housing price in some cities in that period. After 2004, housing prices in these cities have climbed steeply and set new record continually. The golden age of Chinese real estate began from here. Of course, except 2008, in which year the global financial crisis happened and struck the Chinese real estate market heavily. So that the increase of housing price in many cities was short-circuited. Even though, some cities could not get rid of the crisis effect until 2009. But after that, the housing prices began to increase again and hit another high. It seems that the year of 2004 is the great watershed of China housing prices. In that year, the Chinese government publicized a provision which required that previous land transfer issues must be solved before August 13, 2004. Otherwise, the relative government departments have the rights to recover the land. This event is known as the "8.13 Doomsday". After that, Chinese government began to implement land macro-control effectively and strengthen the land reserve acquisition. Gradually, the government became the only monopolizer in China land supply market. Something should be noted is that the land reform was began in 2002, but we can

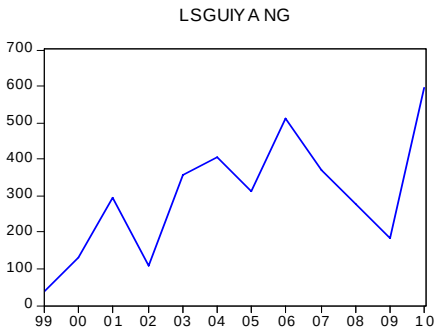
not find the significant changes of housing price in most of the cities in the period from 2002 to 2004. That means the land reform of 2002 did not restrict the land supply effectively. That is why the Chinese government publicized a more strict provision "8.13 Doomsday" in 2004.

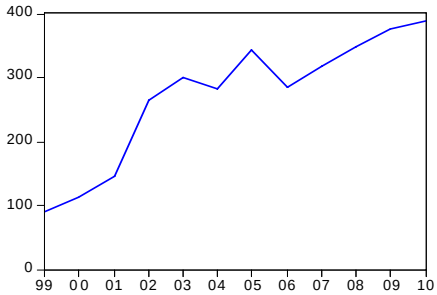
Second, we draw the following graph about the land supply of the 35 main cities:

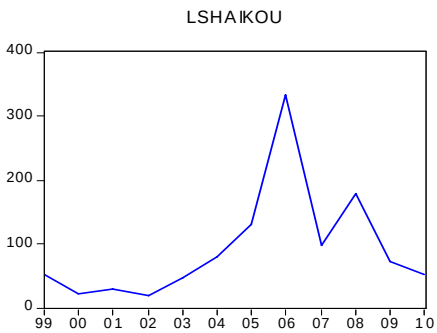


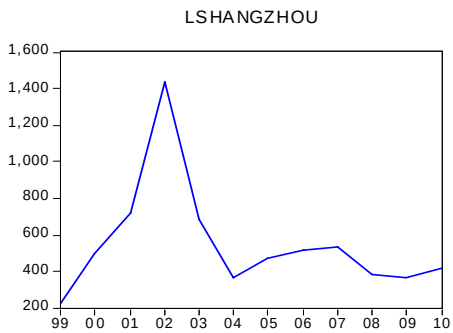

LSFUZHOU
700
600
500
400
300
200
100
99 00 01 02 03 04 05 06 07 08 09 10

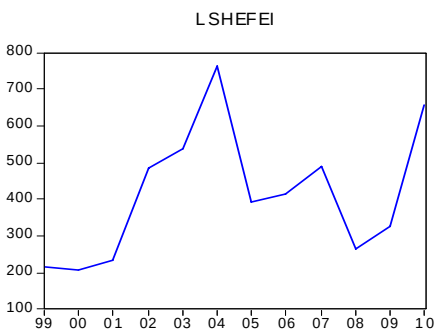

LSGUANGZHOU
1,200
1,000
800
600
400
200
0
99 00 01 02 03 04 05 06 07 08 09 10

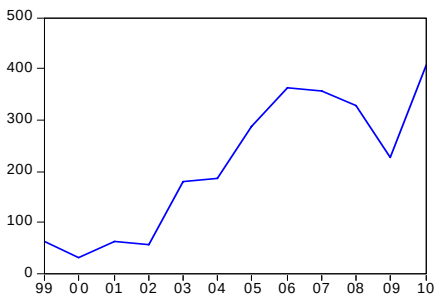

LSGUIYANG
700
600
500
400
300
200
100
0
99 00 01 02 03 04 05 06 07 08 09 10

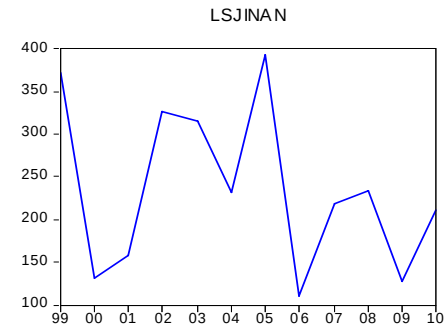

LSHAERBIN
400
300
200
100
0
99 00 01 02 03 04 05 06 07 08 09 10

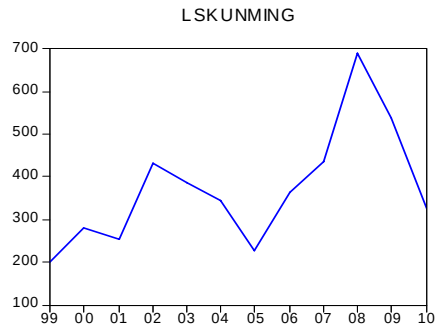

LSHAIKOU
400
300
200
100
0
99 00 01 02 03 04 05 06 07 08 09 10

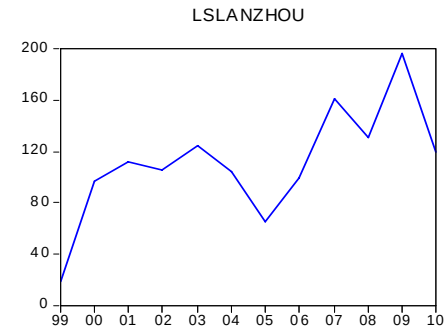

LSHANGZHOU
1,600
1,400
1,200
1,000
800
600
400
200
99 00 01 02 03 04 05 06 07 08 09 10

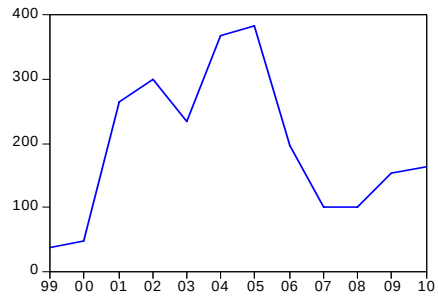

LSHEFEI
800
700
600
500
400
300
200
100
99 00 01 02 03 04 05 06 07 08 09 10

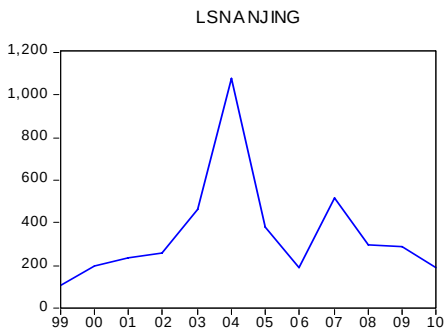

LSHUHEHAOTE
500
400
300
200
100
0
99 00 01 02 03 04 05 06 07 08 09 10

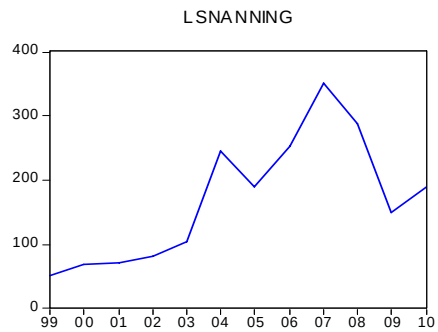

LSJINAN
400
350
300
250
200
150
100
99 00 01 02 03 04 05 06 07 08 09 10

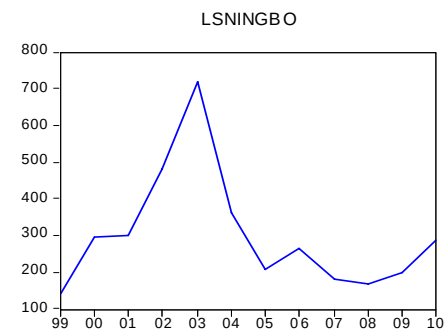

LSKUNMING
700
600
500
400
300
200
100
99 00 01 02 03 04 05 06 07 08 09 10

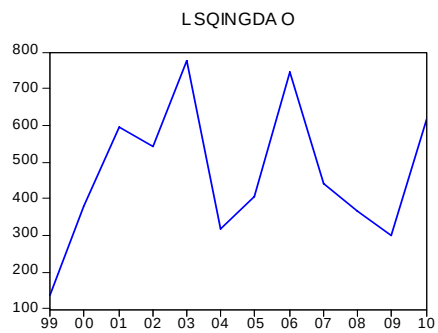

LSLANZHOU
200
160
120
80
40
0
99 00 01 02 03 04 05 06 07 08 09 10

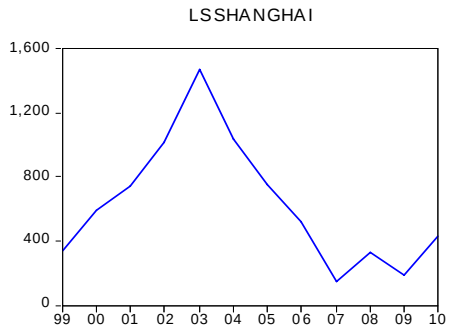

LSNANCHANG
400
300
200
100
0
99 00 01 02 03 04 05 06 07 08 09 10

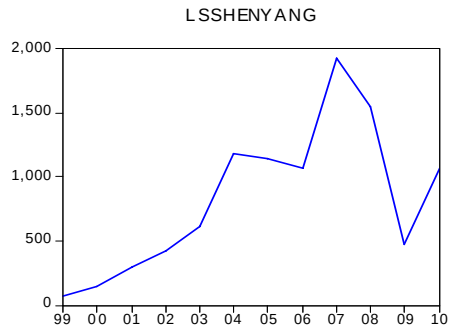

LSNANJING
1,200
1,000
800
600
400
200
0
99 00 01 02 03 04 05 06 07 08 09 10

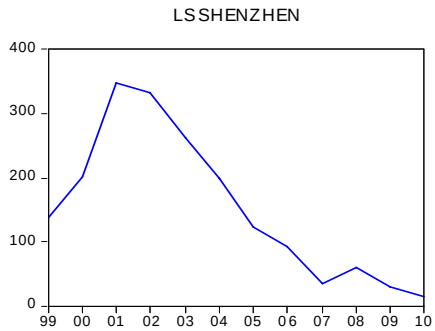

LSNANNING
400
300
200
100
0
99 00 01 02 03 04 05 06 07 08 09 10

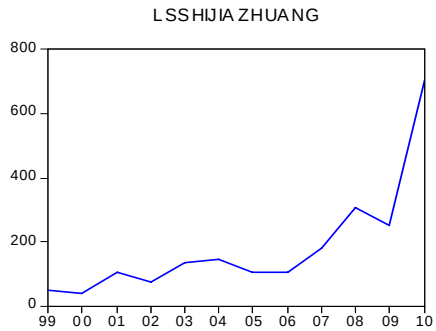

LSNINGBO
800
700
600
500
400
300
200
100
99 00 01 02 03 04 05 06 07 08 09 10

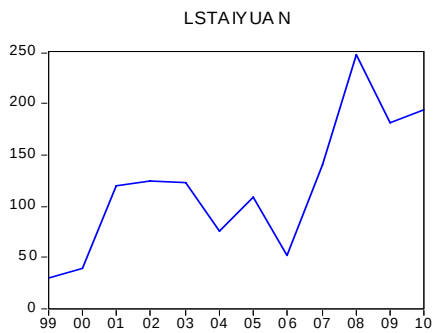

LSQINGDAO
800
700
600
500
400
300
200
100
99 00 01 02 03 04 05 06 07 08 09 10

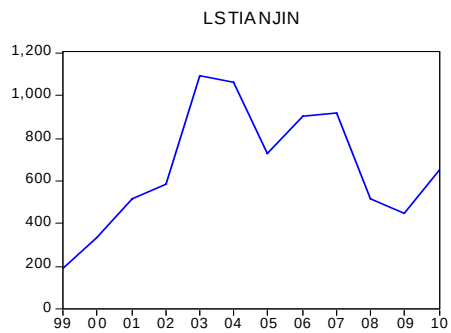

LSSHANGHAI
1,600
1,200
800
400
0
99 00 01 02 03 04 05 06 07 08 09 10

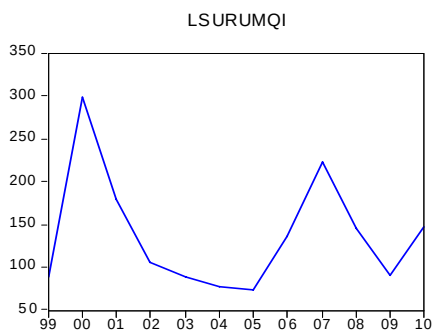

LSSHENYANG
2,000
1,500
1,000
500
0
99 00 01 02 03 04 05 06 07 08 09 10

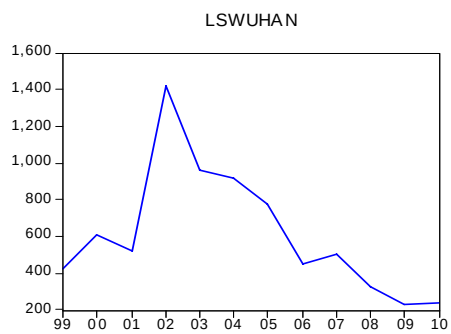

LSSHENZHEN
400
300
200
100
0
99 00 01 02 03 04 05 06 07 08 09 10

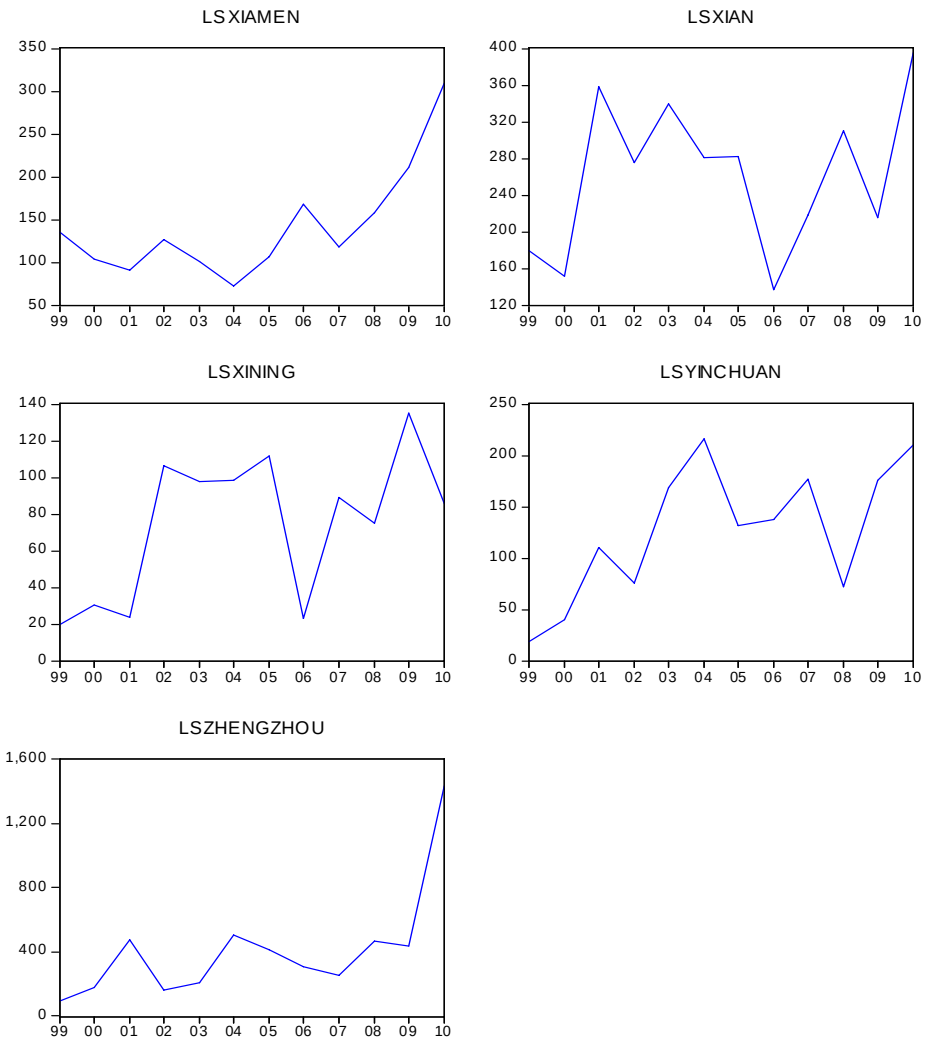

LSSHIJIAZHUANG
800
600
400
200
0
99 00 01 02 03 04 05 06 07 08 09 10


LSTAIYUAN
250
200
150
100
50
0
99 00 01 02 03 04 05 06 07 08 09 10


LSTIANJIN
1,200
1,000
800
600
400
200
0
99 00 01 02 03 04 05 06 07 08 09 10


LSURUMQI
350
300
250
200
150
100
50
99 00 01 02 03 04 05 06 07 08 09 10


LSWUHAN
1,600
1,400
1,200
1,000
800
600
400
200
99 00 01 02 03 04 05 06 07 08 09 10



From the land supply graph above, we can see that the land supplies of the 10 cities, which are the most developed cities in China such as Beijing, Shanghai, Guangzhou, Shenzhen, Nanjing, Hangzhou, Ningbo, Wuhan and Tianjin, were increased with time before the year of 2002 or 2004. In the same period, the housing prices of the cities were stable. But after 2002 or 2004, there

was a rapid decline in the land supplies of these cities. This made the land supply drop to the level of 1999 or an even smaller level. In these cities, there was a 90.3% decrease in the land supply of Shanghai from 2003 to 2007, which was the largest decline. And there was a 68.3% decrease in the land supply of Wuhan from 2002 to 2006, which was the smallest decline. This rapid decline in the land supply corresponded with the steep increase in housing price, which we mentioned in previous. However, the land supplies of other 25 cities are so complex that we can not get an obvious conclusion from the graph. In order to research them further, it is necessary to build a model and analyze empirically.

4. Theoretical Model

In order to realize the relationship between housing price and land supply or other factors, It is necessary to build a theoretical model. We assume a simplificateur model which only include the house consumer, the house investor, the real estate enterprise, and the government.

4.1 Housing Consumer

In the model, we do not distinguish the house buyers and tenants. Since they have the same consumption restriction. A house buyer's consumption is $Pc \bullet c + L(i-\pi+\delta-EPh) \bullet h + (Ph-L)(i-\pi+\delta-EPh) \bullet h \leq Y$; A tenant's consumption restriction is $Pc \bullet c + R \bullet h \leq Y$ where R is the equilibrium annual rental price of private sector housing and $R=(i-\pi+\delta-EPh)Ph$. We call them housing consumers.

They choose h unit housing service and c unit consumption goods, maximize a utility function U(c, h), where $U_c>0$, $U_{cc}<0$; $U_h>0$, $U_{hh}<0$. That is each solves

$$\text{Max } U(c,\ h)$$
$$\text{s.t } (i-\pi+\delta-EPh)Ph\bullet h+Pc\bullet c\leq Y$$

Pc is the price of consumption goods;

c is the quantity of consumption goods;

L is the amount of borrows from banks for each housing unit;

i is the Rate Mortgage;

π is the inflation rate;

δ is the rate of maintenance costs including property taxation;

EPh is the expected rate of future housing price appreciation;

Ph is the housing price;

h is the amount of housing consumption;

Y is per capita disposable income.

We can differentiate with respect to h and c to obtain the following first-order condition:

$$\frac{U_h}{(i-\pi+\delta-EPh)Ph}=\frac{U_c}{Pc} \qquad (\text{I})$$

Equation (I) show that, in the equilibrium, the pre capital utility from housing service equals the pre capital utility from consumption. That means it is indifferent to buy housing or buy consumption goods in equilibrium. If any one of the variables in equation (I) has changed, the consumer will change his consumption choice. If we assume that the consumer utility

function is according to a Cobb-Douglas form that $U(c, h)=c^a h^b$, then we can solve h and c as below:

$$c = \frac{aY}{(a+b)Pc}$$

$$h = \frac{bY}{(a+b)(i-\pi+\delta-EPh)Ph}$$

It is easier to see the relationship between h and other factors. In addition, a change of Pc will lead to the change of consumer preference. This will lead to the change of h finally.

4.2 Housing Investor

J. V. Henderson and Y. M. Ioannides are the first ones, who distinguished housing demand and housing investment demand in them paper published in1983. They researched about the housing tenure choice in that paper. After them, Jan K. Brueckener discussed a complicated model base on them paper in 1997. In that model, he introduced risk investment, riskless investment, housing investment, housing consumption, and consumption goods, researched the consumer's investment behavior and consumption behavior. He found that the net consumption gain from an increase in h equals the utility loss from the additional portfolio distortion in equilibrium. In the next part, we will build a simplificateur model and consider a housing investor following the idea of J. V. Henderson and Y. M.

We assume there is a two-period housing investor. At the beginning of period 1, he receives an income y1. In period 1, he uses the income to buy c amount of consumption goods, which one's price is Pc, to maximize his utility function U(c). At the same time he invests in h housing units at the price Ph. And he rents out the h at price R in period 1. He also invests S to a risk bond (such as stock) in period 1. At the beginning of period 2, he receives the income y2 and the risk investment return S(1+r). But he should pay the mortgage B(1+i)h, where B is the amount of borrows from banks for each housing unit. At the same time, he sales the h housing units and gets Ph(1+EPh)h, where EPh is the expected rate of future housing price appreciation. The housing investor will face the next maximization problem:

$$\begin{aligned} &\text{Max } U(c)+\beta E[V(w)] \\ \text{s.t } &y1+R\bullet h=S+(Ph-B)h+Pc\bullet c \\ &w=y2+S(1+r)+h[Ph(1+EP)-B(1+i)] \end{aligned}$$

where V(.) is the indirect utility function of wealth remaining after the 1st period W and $\beta$is a discount factor.

The f.o.c with respect to h and S lead to the following optimal condition:

$$\begin{aligned} E[V'(w)(1+r)](Ph-B)=&E[V'(w)(1+r)]R+E[V'(w)(1+EP)]Ph \\ &-E[V'(w)]B(1+i) \end{aligned} \qquad (\text{Ⅱ})$$

The equation (Ⅱ) show that, in the equilibrium, it is

indifferent to invest in housing or other risk bond for the housing investor. The any change of the variables in equation (Ⅱ), including y1 and c, will lead the housing investor to change his investment strategy, also chang his housing demand.

4.3 Real Estate Enterprise

In the model of this part, we assume a real estate enterprise whose production function is: $Q=K^aL^{1-a}$ where Q is the amount of housing supply, K is the total capital inputs (except the land cost and labor's wage), L is labor inputs. Here, we use lower case letter to denote variables per capita terms, $q=k^a$ where q=Q/L and k=K/L. The cost function of the enterprise is C=wL+K where w is the labor's wage. The per capita cost is expressed as c=w+k. Therefor, the realestate enterprise maximizes the following profit function:

$$\text{Max } \Pi=Ph \cdot q-c(q)-LP \cdot q/\tau$$

Ph is housing price ;

q is per capita housing production ;

c(q) is per capita cost expect land cost, and $C'(q)>0$, $C''(q)>0$;

τ is the floor area ratio ;

LP is the land price.

We can differentiate with respect to q to obtain the following first-order condition.

$$Ph=c'(q) + LP/\tau$$

From the previous production function and cost function, we get that $c(q)=w+ q^{1/a}$, $c'(q)=(1/a)q^{(1-a)/a}$. We plug the results into the first-order condition above,

$$q=[a(Ph-LP/\tau)]^{a/(1-a)}$$

From the previous assumption, we also get $Q=qL$ and $L=(Q/K^{a})^{1/(1-a)}$.We plug the results into the equation above and get,

$$Q=q(Ph, LP, K) \qquad (Ⅲ)$$

Equation (Ⅲ) show that the amount of housing supply is determined by the housing price, the land price and the total capital inputs (except the land cost and labor's wage).

4.4 Government Problem

We assume that the target of government is to achieve economy growth and social stability subject to the balance of financial. So the government maximizes the following utility function:

$$Max\ Ug=U(ls(e),\ le(e))$$
$$s.t\ \ e \leq LP \bullet LS - T$$

Where, ls is the social stability; le is economy growth; e is the expenditure; LP is the land price; LS is the land supply; T is the tax

revenue. We assume that $\frac{\partial l_s}{\partial e} > 0$ and $\frac{\partial l_e}{\partial e} > 0$ since the government will improve the infrastructure and public welfare from the increasing in fiscal expenditure, which contributes to the social security and economy growth. We differentiate with respect to LS and LP to obtain the following first order conditions:

$$\frac{\partial U}{\partial LP} = U_1 l_s'(e)LS + U_2 l_e'(e)LS$$

$$\frac{\partial U}{\partial LS} = U_1 l_s'(e)LP + U_2 l_e'(e)LP$$

It is obviously that $\frac{\partial U}{\partial LP} > 0$ and $\frac{\partial U}{\partial LS} > 0$. That means, the government utility has a positive relationship with the land price and land supply. But according the classical supply-demand theory, the land price has a negative relationship with the land supply (LP'(LS)<0). In China, the government monopolize the land supply, and face the following maximization problem :

$$\text{Max } \Pi = LP(LS) \cdot LS - C(LS)$$

LP (LS) means that the land price LP is a function of land supply LS; LS is the land supply; C(LS) is the cost of land supply. From the first order condition, we get the following equation.

$$LP(LS) + LP'(LS) = C'(LS)$$

The above equation shows that the government's land sale price is higher than the marginal cost. To achieve this target, the government will reduce the land supply in order to maximize monopoly return from land sales. That is, LS <LSeqm.

5. Empirical Model

5.1 Housing Consumption Demand

On the basis of the theoretical model in previous part, we introduce the function of housing consumption demand, which is a widely used equation (Muellbauer& Murphy, 1997; Liang & Gao, 2007: Stevenson, 2008). It can be described as follows.

$$HCD=f(Y, (i-\pi+\delta-EPh)Ph, Pc)POP \quad (1)$$

HCD is the housing consumption demand ;

Y is per capita disposable income ;

POP is the permanent resident population ;

Ph is the housing price;

Pc is the price of consumption goods;

i is the Rate Mortgage;

π is the inflation rate;

δ is the rate of maintenance costs including property taxation; EPh is the expected rate of future housing price appreciation;

f(•) is the rate of actual household formation which will be a function of the equilibrium annual rental price of private sector housing $R=(i-\pi+\delta-EPh)Ph$, economic resources or income Y, and the cost of other goods and services Pc(Ruijue Peng & William C. Wheaton, 1994).

5.2 Housing Investment Demand

On the basis of the theoretical model about housing investor, we introduce the function of housing investment demand, which is builded following the method that we used in housing consumption demand. The equation of housing investment demand can be described as below.

$$HID=f*(Y, Pc, Ph, EPh, i, R, B, r)POP \quad (2)$$

HID is the housing investment demand ;

Y is per capita disposable income ;

POP is the permanent resident population ;

Ph is the housing price;

Pc is the price of consumption goods;

EPh is the expected rate of future housing price appreciation;

i is the Rate Mortgage;

R is the equilibrium annual rental price of private sector housing which must equal the housing price Ph multiplied by the opportunity cost of housing capital. This cost depends on the rate of maintenance costs δ, the prevailing market long-term interest or mortgage rate i, and the expected rate of future housing price appreciation EP. That is $R=(i-\pi+\delta-EPh)Ph$.(Ruijue Peng & William C. Wheaton, 1994)

B is the amount of borrows from banks for each housing uni t ;

r is rate of return on other investment

f*(•) is the rate of housing investment demand.

5.3 Housing Supply

On the basis of the analysis in theoretical model, housing supply is determined by the housing price, land price and total capital inputs (except the land cost and labor's wage). And the land cost is the largest component of them (Lum, 2002). Since land is an increasingly scarce commodity in most cities, land prices are significantly influenced by the land supply and the land supply policies. Especially, the tighter land supply policies lead to the inelastic land and housing supplies and eventually lead to a high housing price. In China, the government monopolize the land , and impact the land supply and housing supply eventually. Since 1998, the every change of land policy affected the Chinese real estate market deeply.

Moreover, many literatures (Raymond Y.C.Tse,1997) state that real estate enterprises will not develop land as soon as they bought the land from government. In contrast, they will add new land into land banks and delay to develop the land so that they will get more profit from the increased housing price in the next period. "In real estate industry, skills in land banking behavior and timing completions to maximize gains from price inflation tend to be more important than the ability to compete through technical innovation" which was said by Barlow in 1993.

Considering the both aspects above, we introduce the housing demand function as follows.

$$HS=q(Ph, LP, K, LS, LB) \qquad (3)$$

HS is the housing supply ;

Ph is the housing price ;

LP is the land price ;

K is the total capital inputs (except the land cost and labor's wage) ;

LS is land supply ;

LB is the annual land area developed by real estate enterprises.

According to the traditional stock-flow model, which assumes that housing price adjust instantly to equate the demand for housing with the existing stock (Jud&Winkler,2002; Jacobsen, 2005), we build the equilibrium equation as follows.

$$HCD + HID = HS \quad (4)$$

Here, we plug (1), (2) and (3) into (4), and then we get the equilibrium housing price expressed as the following equation.

$$Ph^{*} = \Phi(Y, POP, (i - \pi + \delta - EPh), Pc, B, r, LP, LS, K, LB) \quad (5)$$

A number of empirical analyses suggest that housing price may adjust only gradually in response to shocks (DiPasquale and Wheaton 1990; Hadjimatheou 1976; Whitehead 1974). To test the hypothesis, in this model, a lagged dependent variable was introduced to be an independent variable, which controls the accumulation effect. It is assumed that current housing prices Ph_t depend on both the unobserved current equilibrium price Ph_t^{*} and

the price observed in the previous period Ph_{t-1}.

$$Ph_t=\Theta Ph_t^*+(1-\Theta)Ph_{t-1} \quad (6)$$

We have used (5) for substitute Ph_t^* in (6) to get equation (7), which describe the relationship between the current housing price Ph_t and other factors.

$$Ph_t=\Theta\bullet\Phi(Y_t,\ POP_t,\ (i_t-\pi_t+\delta_t-EPh_t),\ Pc_t,\ B_t,\ r_t,\ LP_t,\ LS_t,\ K_t,\ LB_t)+(1-\Theta)Ph_{t-1} \quad (7)$$

We consider the following reasons in the empirical process.

[1] The China government has started to levy property tax in some cities from 2011. Hence, we can ignore the rate of maintenance costs in the empirical process.

[2] In the equation (7), it is difficult to measure the expected rate of future housing price appreciation directly. However, the changing trajectory of the equation variables was considered to potentially include the housing price expectations (Stevenson, 2008). Hence, we also ignore the EPh in the following empirical process as Liang & Gao (2007) and Stevenson (2008) did.

[3] In the empirical process, we use CPI to instead of Pc, which describe the price of consumption goods. Since the inflation rate equals the change of CPI, we also ignore π in empirical process.

[4] B is the amount of borrows from banks for each housing unit, and it is a factor which will influence the housing investment demand. But it is very different between banks, cities. And it is changed frequently by banks. The most important thing is that we can not find even a complete record about it. We will ignore the variable B since we just care about the land supply more in the paper.

[5] It is difficult to confirm which one should be include in the list of risk investment, which will affect the housing investors' investment strategy. It is difficult to find a reasonable investment portfolio which can substitute r. We will ignore the variable r since we just care about the land supply more in the paper.

[6] Since the lack of corresponding data, we have to use the annual total housing investment (INV) to substitute K. But it must be pointed that there may exist the multicollinearity between INV and LP.

From all the statement above, the panel model can be described as follows:

$$\ln Ph_{it}=\beta_0+\beta_1\ln Y_{it}+\beta_2\ln POP_{it}+\beta_3\ln i_{it}+\beta_4\ln CPI_{it}+\beta_5\ln LS_{it}+\beta_6\ln LP_{it}+\beta_7\ln LB_{it}+\beta_8\ln INV_{it}+\beta_9\ln Ph_{it-1}+u_i+\lambda_t+v_{it}$$
$$i=1,\ 2,\ \cdots,N\ ;\ t=1,\ 2,\ \cdots,T \qquad (8)$$

Ph_{it} is the housing price at period t ;

Y_{it} is the per capita disposable income ;

POP_{it} ispermanent resident population; ;

i_{it} isadjustable Rate Mortgage;

CPI_{it} is consumer price index ;

LS_{it} is the annual land supply ;

LP_{it} is land price ;

LB_{it} is the annual land development area ;

INV_{it} is the annual total housing investment ;

u_i is the individual-specific effect ;

λ_t is the time effect;

v_{it} is the random disturbance items.

6. Empirical Analysis

We estimate housing price though equation (8) using the data of 35 key cities in China. Through the Hausman test, we choose the fixed effect model. The results are presented as below. The variables are the same with equation (8).

Variable	case(1)	case(2)	case(3)	case(4)	case(5)	case(6)
C	-10.89406***	-7.863706***	-8.143642***	-3.160075***	-3.207039***	-3.656392***
	(1.223842)	(1.271301)	(1.212142)	(1.064198)	(1.066843)	(1.165498)
	[-8.90152]	[-6.18556]	[-6.71839]	[-2.96944]	[-3.006101]	[-3.13719]
LOGP?(-1)				0.667211***	0.672511***	0.680363***
				(0.042331)	(0.042533)	(0.046183)
				[15.76159]	[15.81147]	[14.73195]
LOGY?	0.643281***	0.416161***	0.480243***	0.170197***	0.169971***	0.138093**
	(0.063263)	(0.073337)	(0.061068)	(0.051612)	(0.052629)	(0.059531)
	[10.16831]	[5.674630]	[7.864060]	[3.297598]	[3.229612]	[2.319693]

LOGI?	0.112404	-0.009302				
	(0.093588)	(0.082936)				
	[1.201052]	[-0.112162]				
LOGCPI?	1.357450***	1.175751***	1.099106***	0.190676	0.174704	0.255183
	(0.295608)	(0.283543)	(0.244867)	(0.197008)	(0.197684)	(0.220206)
	[4.592058]	[4.146642]	[4.488587]	[0.967860]	[0.883756]	[1.158835]
LOGPOP?	0.736790***	0.541297***	0.599232***	0.409175***	0.417617***	0.444758***
	(0.160077)	(0.160743)	(0.148944)	(0.141221)	(0.141581)	(0.162168)
	[4.602729]	[3.367463]	[4.023201]	[2.897402]	[2.949674]	[2.742578]
LOGLS?		-0.075737***	-0.0703***	-0.02253**		
		(0.013495)	(0.01068)	(0.009070)		
		[-5.612046]	[-6.581887]	[-2.484495]		
LOGLS?(-1)					-0.01806**	
					(0.008641)	
					[-2.08964]	
LOGLS?(-2)						-0.01013
						(0.009521)
						[-1.06356]
LOGLB?		-0.00679				
		(0.011524)				
		[-0.58891]				
LOGLP?		0.340766***	0.355495***	0.136060***	0.140203***	0.139643***
		(0.043553)	(0.042641)	(0.036204)	(0.036414)	(0.040811)
		[7.824111]	[8.336958]	[3.758111]	[3.850251]	[3.421661]
LOGINV?		0.026348				
		(0.021832)				
		[1.206860]				
D1?		0.020058				
		(0.025505)				
		[0.786443]				
D2?		0.057473*	0.044258**	0.062363***	0.064312***	0.062537***
		(0.030197)	(0.022593)	(0.016355)	(0.016486)	(0.017135)
		[1.903285]	[1.958905]	[3.813084]	[3.901103]	[3.649732]
R-squared	0.932832	0.951404	0.951811	0.975603	0.975460	0.974958
Adjusted R-squared	0.926132	0.944845	0.946158	0.972323	0.972162	0.971155
S.E. of regression	0.152544	0.12011	0.11999	0.085185	0.085433	0.085974

	8.8658	4.703036	4.909561	2.213229	2.226149	1.995726
Sum squared resid	214.2370	283.8367	289.6246	384.6487	383.6387	345.4025
Log likelihood	139.2451	145.0544	168.3810	297.4746	295.7048	256.3851
F-statistic	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
Prob(F-statistic)	8.002378	7.932421	7.930133	7.970612	7.970612	8.016229
Mean dependent var	0.561267	0.511433	0.517110	0.512042	0.512042	0.506214
S.D. dependent var	-0.83446	-1.28753	-1.3017	-1.974920	-1.9691	-1.94489
Akaike info criterion	-0.4593	-0.81252	-0.87824	-1.50901	-1.50319	-1.44102
Schwarz criterion	-0.68618	-1.09887	-1.1337	-1.78941	-1.78359	-1.74351
Hannan-Quinn criter.	0.557087	0.946584	0.904732	2.012460	2.009044	2.093302
Durbin-Watson stat						

In the results above, ***, ** and * indicate rejection of the null hypothesis at 1%, 5% and 10%, respectively. The number in ( ) is standard error. The number in [ ] is t-statistic value.

In the case (1), we estimate the housing price using the economic fundamental variables. In the case (2), the variables which reflect the land policy are added in the regression. A comparison between case (1) and case (2) shows that the value of both R^2 and Durbin-Watson statistic increase with the addition of the variables which reflect the land policy. In the case (2), we also introduce two dummy variables (d1 and d2). The d1 is used to capture the effect of the land policy in 2002 and 2003, which is considered

to be the beginning of land restriction (d1=1 in the year 2002 or 2003; d1=0 otherwise). The d2 is used to capture the effect of the land restriction on housing price after 2004 (d2=1 after the year 2004; d2=0 otherwise). The results show that both d1 and d2 have a positive relationship with housing price. But d1 is not significant and d2 is significant under 10% level. The result is quite consistent with the fact that the land reform in 2002 did not restrict the land supply effectively.

In the case (2), the annual total housing investment (INV) is not significant since the multicollinearity with the land price (LP) which we mentioned in the previous part of the paper. Also, the land development area (LB) is not significant since the multicollinearity with land supply. Because the land development area is a portion of the land supply, it depends heavily on the land supply even though the real estate enterprise prefer to add new land into land banks and delay the land development.

The case (3) omits all the variables which are not significant in the case (2). A comparison between case (2) and case (3) shows that the value of both R^2 and the Durbin-Watson statistic have no significant change.

In the case (4), a lagged housing price was introduced as an independent variable, which controls the accumulation effect. We compared the results between case (3) and case (4), and find that the value of both R^2 and Durbin-Watson statistic increase with the addition of the lagged housing price. Thus, the hypothesis is confirmed that housing price may adjust only gradually in response to shocks (DiPasquale and Wheaton 1990; Hadjimatheou 1976; Whitehead 1974).

Case (4) to case (6) examine the effect of land supply. In case (4), the current land supply has a significant negative effect on housing price. In case (5), the one year lagged land supply also has a significant negative effect on housing price. The land supplies in these two cases both are significant under 5% level. But in case (6), the two year lagged land supply is not significant although it has a negative effect on housing price. We also find that the absolute value of the regression coefficient of current land supply in case (4) is bigger than the lagged land supply's in case (5) and case (6). All of above reflect that the effect of current land restriction is stronger than the one in past. In addition, all of the d2 have a significant positive effect on housing price, which are all significant under 1% level. It shows that the effect of land restriction on housing price is dramatic after 2004.

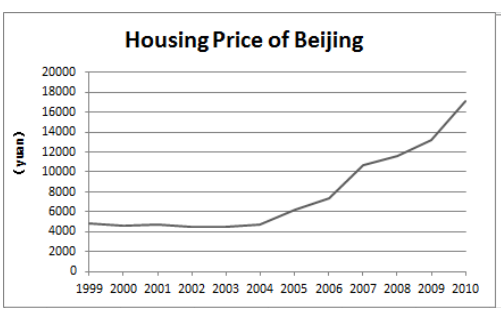
The results also show that the per capita disposable income, as expected, has a significant positive effect on housing price. The permanent resident population has a significant positive effect on housing price. And the land price, which is the cost of the house, has a significant positive effect on housing price.

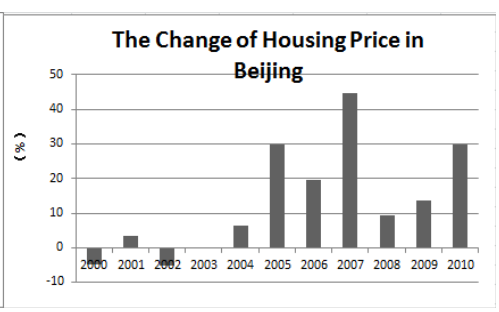
The sign of coefficient of the lagged housing price is positive and significant. And the addition of the lagged variable improves the model, since it improves the goodness of fit. That means the change of housing price can be accumulated. The steep increase of housing price will lead to the expectation that housing price will continually rise in future. And the speculation will increase correspondingly. Also the unreasonable purchasing will increase too, since some people worry

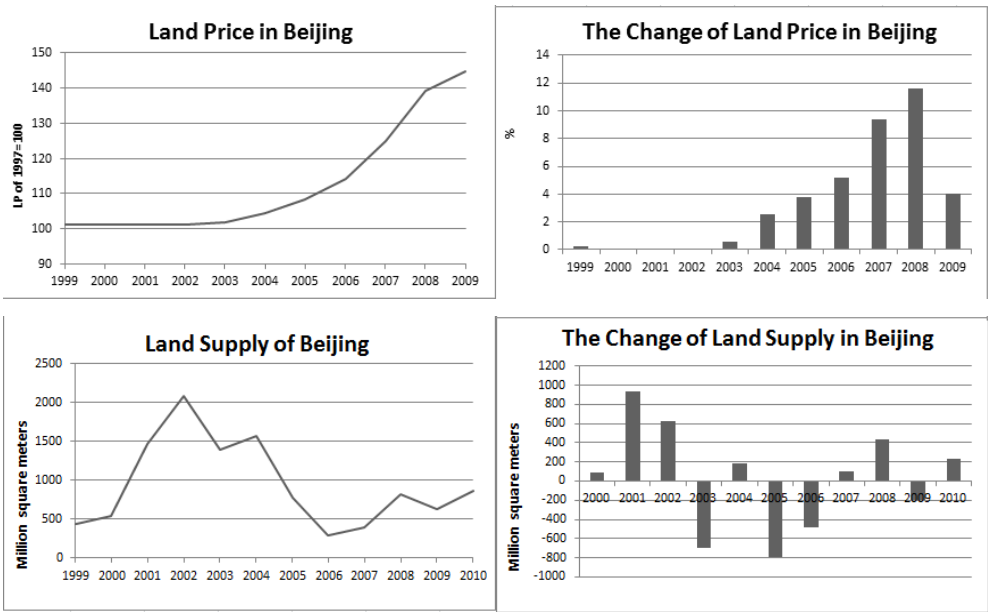
about the housing price will steep increase continuously, so that they can not afford it. Then the housing price increase. When the housing price is stable or decreasing, the situation is the contrary.

In the regression results, all the coefficients of land supply are negative, which confirms that the decrease of land supply can lead to an increase in housing price. In China, the government has completely monopolized and decreased the land supply in order to seek the maximization revenue from land sales. This directly leads the land supply to be less than the actual land demand and finally leads to the steep increase of housing price. In another aspect, the decrease of land supply leads to the expectation of the reduced land supply in future. Under the background, many real estate enterprises start to hoard land. They had hoarded land and resold it to seek the huge speculative profit before 2004. And they have been hoarding land and delaying the land development to seek huge profit from the increased housing price after 2004, since China government has forbidden the private land transactions and monopolized the land supply after 2004. With more and more land being hoarded, the decrease of land supply is exacerbated. And it also leads to the steep increase of housing price.

7. An Example of Beijing







From the graphs above, we can see that, the housing price and land price of Beijing were stable before 2002. At the same time, the land supply increased year by year. Plentiful of lands that the government allotted to the enterprises, were transferred in the land market through the private negotiation. The land supply reached the peak value in 2002, about 2092 Million square meters.

Since 2002, there were two declines in the land supply of Beijing. The 1st one was the decline in 2003. It was due to the China central government publicized a provision in May 2002 to forbid the land transactions through private negotiations. And Beijing, as the capital of China, carried out the regulation first.

The 2nd decline happened in 2005, after the publishment of the policy, which was called "August 13 Doomsday" in 2004. In

the following years, the government strengthened macro-control on land supply, carried on the land reserve system, and forbade the private deal of land use right effectively. Actually, the government had monopolized the land supply. From 2004, the land supply had decreased year by year, and reached the lowest value (295 Million square meters) in 2006. After that year, the land supply fluctuated and increased slightly. The land price increased whit year, the amount of increase researched the highest value (11.6%) in 2008. In 2009, affected by the global finical crisis, the land price stoped the steep increase, but still had a positive rise (2.3%).

What we need to pay attention to is that, there was a 84% decline in the land supply of Beijing from 2002 to 2006. This apparently led to the increase of land price and housing price. Actually, beyond the increase of the prices, the sharply decline of land supply was the method that the government used to seek the optimal land supply so that they could get the maximization revenue form land sales. After that, the only thing that the government need to do is to adjust the land supply according to the demand. This will explain the fructuation of land supply after the sharply decline.

In order to analyze the relationship between Beijing's land supply and housing price, we will focus on the primary variables and build a time series model. In order to eliminate the effect of CPI , we will define the variables as follows: logp=log(P/CPI), logy=log(Y/CPI), logLS=log(LS), where P is the housing price, Y is the per capita disposable income, LS is the land supply. After the

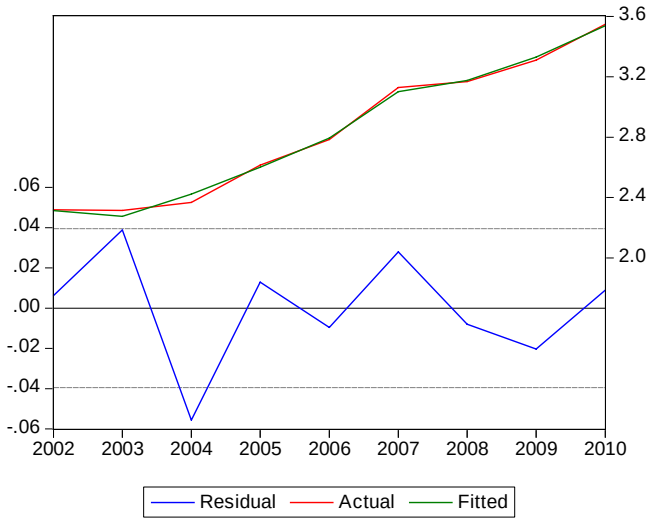
unit root test and co-integration test, also considering the autocorrelation of residuals, we build the long-term equation as follows:

$$logp_t = -0.110457 * logLS_t + 0.379699 * logy_t + 0.795795 * logp_{t-1} - 1.467922 * AR(1) - 0.965013 * AR(2)$$

Variable	Coefficient	Std. Error	t-Statistic	Prob.
$logLS_t$	-0.110457	0.004857	-22.74042	0.0000
$logy_t$	0.379699	0.023071	16.45758	0.0001
$logp_{t-1}$	0.795795	0.024559	32.40341	0.0000
AR(1)	-1.467922	0.293025	-5.009548	0.0074
AR(2)	-0.965013	0.266507	-3.620962	0.0223

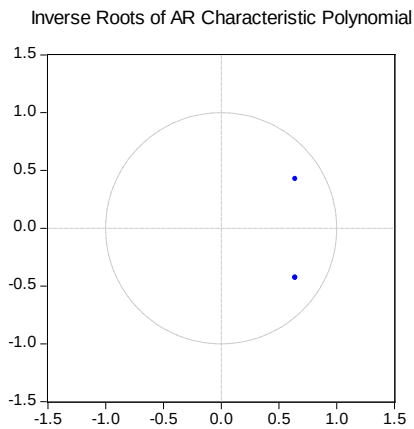
R^2=0.996408 DW=3.030207

The actual, fitted, residual graph is as below:

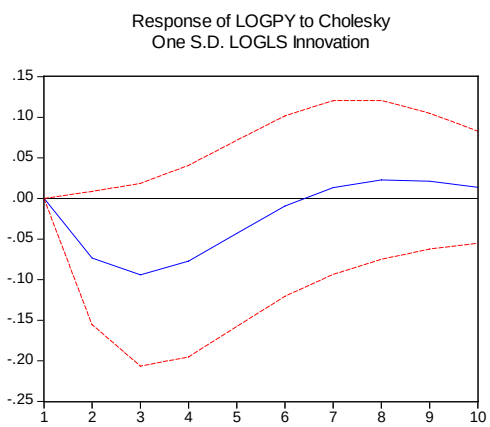


The next, we choose the lag interval of endogenous according

to the VAR Granger Causality Test and the lag length criteria, and we build the VAR model of log(P/Y) and logLS. From the AR root graph, it is certain that the VAR model is stable. The graph is as below:



The graph of impulse response is as below:



These graphs show that the increase of land supply clearly has a negative effect on housing price. When the land supply

changes, there is no effect on the housing price in the first year; in the second year, however, the land supply change begin to affect housing price negatively, and reaches its maximum in the third year. From the fourth year on, this effect begins to abate.

8. Conclusion

In the paper, we extend the traditional stock-flow model and estimate housing price though the empirical model using the data of 35 key cities in China. In the regression results, all the coefficients of land supply are negative and significant, which confirms that the decrease of land supply can lead to an increase in housing price. We also find that the effect of current land restriction is stronger than the one in past. And, the dummy variable, which is used to capture the effect of the land restriction on housing price after 2004, have a significant positive effect on housing price. It shows that the effect of land restriction on housing price is dramatic after 2004.

From the results of the paper, we conclude that the housing price in China has already deviated upward from the growth path of economic fundamentals. The restriction of land supply is the most important reason of this. Therefore, if we want to solve the housing price problem, we should not ignore the problem of land supply. The only way to make housing price come back to the normal growth path of economic fundamentals is lifting the constriction of land supply.

References

Albert Saiz (2010), "The Geographic Determinants of Housing Supply," *Quarterly Journal of Economics*, Vol.125, Nr.3 MIT Press (2010), p.1253--1296.

Cheshire, Paul (2004) "The British housing market: contained and exploding," *Urban policy and research*, 22(1). pp. 13-22 .ISSN 0811-1146

Hong Zhang (2008), "Effects of Urban Land Supply Policy on Real Estate in China: An Econometric Analysis," *Journal of Real Estate Literature*, VOLUME 16, NUMBER 1, 2008, pp. 55-72.

Jan K. Brueckner (1997), "Consumption and Investment Motives and the Portfolio Choices of Homeowners," *Journal of Real Estate Finance and Economics*, 15: 2, 159-180.

Jinhai Yan, Lei Feng, Helen X. H. Bao (2010), "House price dynamics, evidence from Beijing," *Front. Econ.. China*, 2010, 5(1): 52-68.

John Muellbauer and Anthony Murphy (1997), "Booms and Busts in the UK Housing Market," *The Economic Journal*, 107(Number), 1701-1727.

Jud, G. D. and Daniel T. Winkler. "The Dynamics of Metropolitan Housing Prices," *Journal of Real Estate Research*, vol. 23, no. 1-2, 2002, pp. 29-45.

J. V. Henderson and Y. M. Ioannides (1983), "A Model of Housing

Tenure Choice," *The American Economic Review*, Vol. 73, No. 1(Mar.,1983), pp.98-113.

Lum S. K. (2002), "Market fundamentals, public policy and private gain: House price dynamics in Singapore," *Journal of Property Research*, 19(2): 121-143.

Qi Liang and Hua Cao (2007), "Property prices and bank lending in China," *Journal of Asian Economics*, 18: 63-75.

Raymond Y. C. Tse (1998), "Housing Price, Land Supply and Revenue from Land Sales," *Urban Studies*, Vol. 35, No. 8, 1377-1392.

Ruijue Peng and William C. Wherton (1994), "Effects of Restrictive Land Supply on Housing in Hong Kong: An Econometric Analysis," *Journal of Housing Research*, Volume5, Issue 2, Pages: 263-291.

Simon Stevenson (2005), "Modelling Housing Market Fundament ls Empirical Evidence of Extreme Market Conditions," *Real Estate Economic*s, 36(1): 1-29.

Vyacheslav Mikhed and Petr Zemcik (2009), "Do house prices reflect fundamentals Aggregate and panel data evidence," *Journal of Housing Economics*, 18: 140-149.

국문초록

중국은 1998년부터 부동산 시장을 설립하기 시작했다. 중국 정부는 2002년부터 부동산 시장에 개입하고 토지 공급을 제한하기 시작했다. 다음부터는 일련의 조항들을 통해 중국 정부가 토지 공급 시장을 독점하길 위해서 개인의 토지 거래를 금지하고 국가 토지 구입 및 저장 시스템을 구축하기 시작했다. 거의 동시에, 주택 가격의 가파르고 지속적인 증가와 토지 공급의 급속한 하락이 있었습니다. 많은 이론 및 실증적인 논문은 주택 가격이 경제 기초뿐 아니라 정부의 정책까지 반영한다는 결론을 내렸다. 그러므로 토지 정책은 중국 주택 가격에게 매우 중요한 영향을 미칩니다. 본 논문에서 우리는 이론적인 모델을 통해 주택 수요, 주택 공급과 정부의 토지 공급을 분석했다. 그 다음에, 우리는panel data 모델을 설립하고 중국의 35개 주요 도시의 데이터를 통해 실증적으로 분석했다. 그 결과는 중국 토지 공급과 주택 가격 사이에 상당한 마이너스 관계가 있다는 것을 보여줍니다. 특히, 우리는 중국 정부 토지 독점 전후의 결과를 비교하면, 정부 독점된 후에 마이너스 관계 더욱 두드러지고 있는 것이 나타났습니다. 그리고, 우리는 ECM 와VAR 모델을 통해 몇 가지 개별적인 도시를 분석했다. 마지막으로, 우리는 중국의 주택 가격은 이미 경제 기초의 성장 경로에서 이탈하고 있다는 결론 내렸습니다. 토지 공급의 제한이 이문제의 가장 중요한 유인이다. 우리가 주택 가격 문제를 해결하려면, 토지 공급의 문제를 무시해서는 안됩니다. 이 문제를 해결되는 유일한 방법은 토지 공급의 재한을 푸는 것입니다.

주요어 : 주택 가격, 토지 공급, 토지 독점, panel data 모델, ECM,

VAR 모델
학 번 : 2008-22465